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INTRODUCTION

The Imperial Valley drains are listed as impaired on the State of California's Clean Water Act Section 303(d) List, in part, because sediment violates water quality objectives that protect beneficial uses. These beneficial uses include: warm freshwater habitat (WARM); wildlife habitat (WILD); preservation of rare, threatened, and endangered species (RARE); contact and non-contact recreation (REC I and REC II); and freshwater replenishment (FRSH) (California Regional Water Quality Control Board 2002).

Accordingly, Sedimentation/Siltation Total Maximum Daily Loads (TMDLs) are proposed for the Imperial Valley drains, by the California Regional Water Quality Control Board, Colorado River Basin Region (Regional Board). This TMDL applies to three Imperial Valley drains (Niland 2, P, and Pumice) and their tributary drains (Vail 4A, Vail 4, Vail 3A, Vail 3, and Vail 2A feed into Pumice). These drains total 39 miles long, and are referred to in this document as "subject drains". Total suspended solids (TSS) and turbidity data indicate that the subject drains are impaired by sediment.

Imperial Valley drains are sustained and dominated by agricultural return flows discharged from Imperial Valley farmland. The subject drains empty directly into the Salton Sea. Figure 1 is a map of the project area.

Figure 1: Project Area for the Imperial Valley Drains (Niland 2, P, and Pumice) Sedimentation/Siltation TMDL

This TMDL seeks to achieve water quality objectives and protection of beneficial uses, by reducing the amount of sediment. A TMDL quantifies the amount of pollutant loading that a waterbody can assimilate without violating water quality objectives. When allowable loads are achieved, they are expected to eliminate impairments.

Significant public input occurred during TMDL development, including recommendations from the Imperial Valley Sedimentation/Siltation TMDL Technical Advisory Committee (Silt TMDL TAC) composed of private and government stakeholder groups (Appendix A). This draft TMDL will be circulated for public review before consideration of approval by the Regional Board during a public hearing.

Adoption and approval of this TMDL will bring more of the Imperial Valley into compliance with a uniform sedimentation/siltation standard, as represented by a Total Maximum Daily Load numeric target. The Alamo River sedimentation/siltation TMDL was adopted by the Regional Board in June 2001; approved by the State Water Quality Control Board, Office of Administrative Law (OAL) in May 2002; and approved by the U.S. Environmental Protection Agency (USEPA) in June 2002. The New River sedimentation/ siltation TMDL was adopted by the Regional Board in June 2002, approved by OAL in January 2003, and approved by USEPA in March 2003.

PROBLEM STATEMENT

This section includes a description of: (a) water quality objectives and beneficial uses, and (b) impairments caused by sedimentation/siltation.

A. WATER QUALITY OBJECTIVES AND BENEFICIAL USES

Narrative water quality objectives for sediment, suspended solids, and turbidity were established by the Regional Board to protect beneficial uses of waterways in the Region. Violations of water quality objectives indicate that beneficial uses are impaired. Table 1 summarizes water quality objectives applying to all surface waters in the Region. Table 2 summarizes beneficial uses specific to Imperial Valley drains (including the subject drains).

Table 1: Water Quality Objectives for All Surface Waters in the Region

Parameter	Water Quality Objective
Sediment	The suspended sediment load and suspended sediment discharge rate to surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.
Suspended Solids	Discharges of wastes or wastewater shall not contain suspended or settleable solids in concentrations which increase the turbidity of receiving waters, unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in turbidity does not adversely affect beneficial uses.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses.

(California Regional Water Quality Control Board 2002)

Table 2: Beneficial Uses of the Imperial Valley Drains

Beneficial Use	Description
Warm Freshwater Habitat (WARM)	Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
Wildlife Habitat (WILD)	Uses of water that support terrestrial ecosystems including, but not limited to, the preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), water, and food sources.
Preservation of Rare, Threatened, and Endangered Species (RARE)	Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered.
Contact Recreation (REC I)	Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, and use of natural hot springs. **Note:** For Imperial Valley drains, the only known REC I usage is infrequent fishing, which is unauthorized.
Non-Contact Recreation (REC II)	Uses of water for recreational activities involving proximity to water, but not normally involving contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment of the above activities. **Note:** For Imperial Valley drains, such activity is unauthorized.
Freshwater Replenishment (FRSH)	Uses of water for natural or artificial maintenance of surface water quality or quantity.

(California Regional Water Quality Control Board 2002)

B. IMPAIRMENT BY SEDIMENT

Sediment data, represented by total suspended solids (TSS) and turbidity, indicate that the subject drains are impaired by sediment. TSS and turbidity are at excessive levels, as in the Alamo and New Rivers. Farming practices along the two rivers and the subject drains are similar. Table 3 summarizes TSS and turbidity data for the subject drains.

Table 3: Total Suspended Solids (TSS) and Turbidity of the Subject Drains – Annual Average at the Outlet

Drain Name	TSS (mg/L*)	Turbidity (NTU**)
Niland 2	410	455
P	235	195
Pumice	610	250
All Drains	**418**	**339**

* = milligrams per liter
** = nephelometric turbidity unit

Sediment as an Impairment to Aquatic and Terrestrial Organisms
Excess sediment in the water column and in bottom deposits threatens many aquatic and terrestrial organisms that utilize Imperial Valley drain habitat, as well as habitat downstream of the drains. Diversity is reduced as sediment-sensitive species disappear.

In the water column, excess sediment can: (1) clog fish gills, causing death or inhibiting growth, (2) prevent successful development of fish eggs and larvae, (3) modify natural fish movements and migration, and (4) reduce food abundance available to fish. Excess sediment in the water column also can: (1) reduce light penetration, which reduces the ability of algae to produce food and oxygen, (2) affects other parameters such as temperature, and (3) interferes with mixing, which decreases oxygen and nutrient dispersion to deeper layers.

In bottom deposits, excess sediment can: (1) smother bottom-dwelling organisms, (2) cover breeding areas, and (3) smother eggs. Excess bottom sediment in riparian habitat can bury tree and shrub roots, as well as reeds, cattails, and arrowheads used for food and cover. Riparian areas constitute sensitive habitat, as they provide important habitat for songbirds and serve as potential wildlife movement corridors. Excess bottom sediment in wetland habitat can choke out plants that are used for food and cover, and can drastically reduce the health and numbers of organisms (e.g., plankton, detritus, aquatic vegetation) at the base of the food web. Wetland areas, as part of the Salton Sea delta, are a critical stop for migrating birds on the ecologically important Pacific Flyway, a major migratory route connecting Canada and the U.S. to Mexico and Central America.

Sediment as a Carrier for DDT, DDT Metabolites, and Toxaphene
Imperial Valley has one of the highest maximum Total DDT concentrations (in fish tissue) in the Colorado River Basin Region (Table 4) and the State of California (State Water Resources Control Board 1978-1995). Total DDT concentrations in fish tissue routinely exceed the National Academy of Sciences (NAS) recommended maximum concentration (State Water Resources Control Board 1978-1995) and the U.S. Food and Drug Administration (FDA) Action Level. (NAS guidelines are meant to protect species that consume DDT at all food chain levels. FDA Action Levels are meant to protect humans from chronic effects of DDT consumption, and are based on consumption quantity and frequency.)

Table 4: DDT in Fish Tissue -- Data by Surface Water for the Colorado River Basin Region

Station Location	Number of Samples	Number of Organisms	Number Exceeding NAS Criteria	Number Exceed-ing FDA Action Level	Maximum in parts per billion wet weight (ppb, ww)	Mean (ppb, ww)	90th Percentile (ppb, ww)
Imperial Valley	116	848	41	6	9153	1251	3308
Alamo River (all stations)	27	137	21	5	9153	2816	5468
Alamo River/ International Boundary	4	56	3	0	1371	955	1305
Alamo River/ Holtville	1	3	0	0	515	515	
Alamo River/ Brawley	1	3	0	0	460	460	
Alamo River/ Calipatria	21	75	17	5	9153	3392	5517
New River (all stations)	34	176	12	0	3368	1090	2584
New River/ International Boundary	8	85	1	0	1209	539	825
New River/ Westmorland	26	91	11	0	3368	1259	2687
Agricultural Drains	30	399	9	1	5106	1087	3324
Salton Sea	21	102	0	0	276	97	180
Fig Lake	7	40	0	0	592	145	321
Wiest Lake	1	4	0	0	38	38	
Salt Creek Slough	3	6	1	0	3319	1193	
Coachella Valley Stormwater Channel	7	84	2	0	2883	1224	2695
Palo Verde Outfall Drain	9	45	1	0	1475	354	632
Colorado River (all stations)	17	90	0	0	855	102	165
Colorado River/ Needles	3	12	0	0	77	38	
Colorado River/ Pichaco	2	11	0	0	46	28	
Colorado River/ Upstream of Imperial Dam	3	21	0	0	27	15	
Colorado River/ Cibola	6	34	0	0	175	96	
Colorado River/ International Boundary	3	12	0	0	855	313	

(State Water Resources Control Board 1978-1995)

DDT (Dichlorodiphenyl trichloroethane) was a widely used insecticide in the United States between 1942 and 1973. DDT breakdown products include the metabolites DDE (Dichlorodiphenyl dichloroethylene) and DDD (Dichlorodiphenyl dichloroethane). The sum of DDT, DDE, and DDD commonly are referred to as "Total DDT." DDT, DDE, and DDD are known carcinogens listed in the Governor's Proposition 65 List of Chemicals Known to the State of California to Cause Cancer or Reproductive Toxicity. DDT is also a recognized developmental toxicant. DDT was banned in the United States in 1973 and in Mexico in 1983.

DDT was used extensively in Imperial Valley as a low-cost, broad-spectrum insecticide (Setmire et al. 1993). The pesticide dicofol, currently in use in Imperial Valley, contains DDT and may contribute DDT metabolites to Imperial Valley. Studies in other areas of California show that DDT breakdown products have a very long lifetime in agricultural fields with clay soils (California Department of Food and Agriculture 1985), such as soils in Imperial Valley.

DDT and its metabolites are organochlorine pesticides with low water solubility. As such, they have a propensity to attach to negatively-charged clay-rich sediments, like those in Imperial Valley. Therefore, sediment-laden agricultural runoff serves as the transport mechanism by which DDT compounds adhering to soil are introduced to the drain water system. DDT metabolites have been detected in bottom sediment samples in Imperial Valley waterways (Setmire et al. 1990, Setmire et al. 1993, Eccles 1979).

DDT and its metabolites have a high propensity to store themselves in body fat, especially in the central nervous system, liver, and kidneys. In these organs, organochlorine pesticides damage important enzyme functions and disrupt biochemical cell activity (U.S. Environmental Protection Agency 1989). These properties allow DDT and its breakdown products to bioaccumulate in fish and wildlife, with severe consequences for wildlife at the top of the food chain. DDT effects on birds and aquatic organisms are well-documented by scientists throughout the world. Adverse effects include egg thinning, egg breakage, decreased egg productivity, decreased hatching and fledging success, decreased nesting success, chick mortality during hatching, and death (Kaloyanova and El Batawi 1991).

Fish and bird specimens from the Imperial Valley routinely have some of the highest DDE concentrations in California (State Water Resources Control Board 1978-1995, U.S. Environmental Protection Agency 1980, Ohlendorf and Miller 1984, Mora et al. 1987, Setmire et al. 1993). Some of the highest concentrations were found in birds feeding in agricultural fields on invertebrates and other food items (Setmire et al. 1993).

Reproductive success of colonial nesting birds has declined at the Salton Sea, likely due to high levels of multiple contaminants, particularly organochlorine pesticides, in eggs (Bennett 1998). DDE-caused reproductive depression in birds has emerged as a serious concern in the Salton Sea area. Resident birds typically had higher DDE concentrations than migratory species. The endangered California brown pelican, threatened bald eagle, and endangered peregrine falcon, among others, are exposed to DDE levels that pose a high concern level and an increased risk of adverse effects (Setmire et al. 1993). People who consume fish from Imperial Valley waterways also are at risk.

The Imperial Valley also has the highest maximum toxaphene concentration (in fish tissue) in the Colorado River Basin Region (Table 5). Toxaphene, like DDT, is an organochlorine chemical with low water solubility, a propensity to attach to soil particles, and a tendency to bioaccumulate in fish and wildlife. Toxaphene has a half-life in soil of up to 14 years (Genium Publishing Corporation 1999), has high chronic toxicity to aquatic life (U.S. Environmental Protection Agency 1989), and is a recognized Proposition 65 carcinogen. USEPA canceled all registered toxaphene uses in 1983 (Ware 1991).

Table 5: Toxaphene in Fish Tissue -- Data by Surface Water for the Colorado River Basin Region

Station Location	Number of Samples	Number of Organisms	Number Exceed-ing NAS Criteria	Number Exceeding FDA Action Level	Maximum (ppb, ww)	Mean (ppb, ww)	90th Percentile (ppb, ww)
Imperial Valley	117	853	51	0	3400	323	940
Alamo River (all stations)	27	137	20	0	2200	571	1588
Alamo River/ International Boundary	4	56	3	0	300	198	288
Alamo River/ Holtville	1	3	0	0	0	0	
Alamo River/ Brawley	1	3	0	0	0	0	
Alamo River/ Calipatria	21	75	17	0	2200	697	1870
New River (all stations)	35	181	17	0	3400	333	810
New River/ International Boundary	8	85	0	0	0	0	0
New River/ Westmorland	27	96	17	0	3400	431	858
Agricultural Drains	27	393	14	0	2800	399	1128
Salton Sea	21	102	0	0	0	0	0
Fig Lake	7	40	0	0	0	0	
Wiest Lake	1	4	0	0	0	0	
Salt Creek Slough	3	6	0	0	0	0	
Coachella Valley Stormwater Channel	7	84	3	0	440	133	368
Palo Verde Outfall Drain	9	45	2	0	1200	148	344
Colorado River (all stations)	17	90	0	0	0	0	
Colorado River/ Needles	3	12	0	0	0	0	
Colorado River/ Pichaco	2	11	0	0	0	0	
Colorado River/ Upstream of Imperial Dam	3	21	0	0	0	0	
Colorado River/ Cibola	6	34	0	0	0	0	
Colorado River/ International Boundary	3	12	0	0	0	0	

(State Water Resources Control Board 1978-1995)

NUMERIC TARGET

This section describes the numeric target that will be used to reduce sediment loads to meet water quality objectives (Table 1) that protect Imperial Valley Drain beneficial uses (Table 2).

A. NUMERIC TARGET

The numeric target established by this TMDL is an annual average instream total suspended solids (TSS) concentration of 200 mg/L. Achieving the target is expected to result in the subject drains being unimpaired by sedimentation/siltation and protective of beneficial uses.

B. BASIS FOR NUMERIC TARGET

TSS and turbidity were chosen as water column sediment indicators, in accordance with EPA's *Protocol for the Development of Sediment TMDLs* (U.S. Environmental Protection Agency 1999), due to the relatively stable flows, average sediment concentrations, and availability of TSS and turbidity data.

The National Academy of Sciences (NAS)[1] recommends the following general maximum total suspended solids (TSS) concentrations to protect aquatic life (National Academy of Sciences 1972):

High Level of Protection	25 mg/L
Moderate Protection	80 mg/L
Low Level of Protection	400 mg/L

The EPA's *Quality Criteria for Water* (U.S. Environmental Protection Agency 1986), also known as the "*Gold Book,"* reaffirmed NAS recommended criteria. EPA's subsequent "National Recommended Water Quality Criteria: 2002" (U.S. Environmental Protection Agency 2002) upheld the Gold Book criteria. The EIFAC literature survey revealed that healthy fisheries sometimes occur at concentrations of 80 to 400 mg/L TSS. However, death rate is substantially greater for fish living for long periods in waters containing TSS in excess of 200 mg/L than for fish living in cleaner water. Only poor fisheries are likely to be found in waters that normally carry greater than 400 mg/L TSS (European Inland Fisheries Advisory Council 1965).

The numeric target proposed in this TMDL was based, in part, on NAS and EIFAC recommendations that suggest general levels of suspended solids that would be protective of aquatic ecosystems (not limited to coldwater streams). The 200 mg/L target is within the upper range of these recommendations. Applying background water quality would have resulted in a more stringent target. Additionally, the numeric target also was based on other scientific literature (Wood and Armitage 1997), monitoring data, and staff professional judgment.

The numeric target takes into account that the subject drains are a warmwater system. Warmwater streams are often muddy with silt and sandy bottoms, and are generally more turbid than coldwater streams (Waters 1995).

[1] NAS guidelines assess pollutant bioaccumulation. NAS guidelines were established to protect organisms exposed to toxic compounds and to protect species that consume these contaminated organisms.

C. EXISTING CONDITIONS COMPARED TO NUMERIC TARGET

Existing TSS varies among the subject drains. However, all subject drains have current TSS measurements in excess of the numeric target. Table 6 compares existing TSS measurements to the numeric target.

Table 6: Comparison of Existing Conditions to Numeric Target

Drain Name	Existing TSS (mg/L)	Target TSS (mg/L)
Niland 2	410	200
P	235	200
Pumice	610	200
All Drains	**418**	**200**

SOURCE ANALYSIS

This section identifies and quantifies natural and human-related sediment sources to the subject drains (Niland 2, P, and Pumice), including their tributary drains. A source analysis: (a) determines the amount of sediment reduction needed to meet numeric targets, and (b) allocates sediment allowances among sources.

A. METHODOLOGY

The source analysis methodology is the same one used for previous sediment/silt TMDLs (e.g., New River, Alamo River) in the Region. Total suspended solids (TSS) and turbidity data came from Regional Board water samples analyzed by a contract laboratory, pursuant to a Quality Assurance Project Plan. (Water samples were collected at drain outlets.) Daily irrigation delivery and monthly drain flow data from January 1997 to December 2002 came from the Imperial Irrigation District (Imperial Irrigation District 2003).

Prior to analysis, data were statistically evaluated to determine whether they were normally distributed. Data also were analyzed for potential outliers using Chauvinet's Criterion, as recommended by Kennedy and Neville 1986. Outlier data were not included in the analysis.

A mass balance approach was used to calculate TSS concentration and the corresponding sediment load for each subject drain, to determine total sediment load for all subject drains combined. Total sediment load in the subject drains is the sum of sediment contributions from individual sources. Sediment sources include agricultural tailwater, dredging, natural sources (i.e., in-stream erosion and wind deposition), farmland runoff, and urban runoff. Therefore, total sediment load to the subject drains can be represented mathematically by the following formula:

$$L_{Drains} = L_{Tailwater} + L_{Dredging} + L_{Natural\ Sources} + L_{Farmland\ Runoff} + L_{Urban\ Runoff}$$

where:

L_{Drains}	=	total sediment load to the subject drains
$L_{Tailwater}$	=	sediment load from agricultural tailwater
$L_{Dredging}$	=	sediment load from dredging
$L_{Natural\ Sources}$	=	sediment load from natural sources, specifically in-stream erosion and wind deposition
$L_{Farmland\ Runoff}$	=	sediment load from farmland runoff
$L_{Urban\ Runoff}$	=	sediment load from urban runoff

Agricultural Tailwater

Agricultural sediment load was calculated by multiplying TSS concentration (average at the outlet, in mg/L) by flow (annual average over six years, in acre-feet), then using a factor to convert TSS concentration (mg/L) into sediment load (average, in tons/year). Tributary drain data were incorporated into the appropriate subject drain. Agricultural return flow was derived as being proportional to irrigation water deliveries.

Dredging

Dredging load was calculated by multiplying the percent of flow affected by dredging (total flow x percent of time that dredging occurs in any drain) by the TSS concentration and by a factor to convert mg/L to tons. Data used in calculations included: (a) IID flow data, (b) IID annual sediment removal information (Knell 2000), from which a ratio was used to determine the amount of time that dredging occurs in any drain (determined to be 0.7%), and (c) Regional Board monitoring of an IID dredging operation, which showed that dredging increased downstream TSS concentration from the low hundreds to as high as 5,000 mg/L.

Natural Sources (In-Stream Erosion and Wind Deposition)
Natural source (in-stream erosion and wind deposition) load was calculated using an empirical method.

Farmland Runoff
Farmland runoff load was calculated using: (a) total acreage of farmland that could influence the subject drains, and (b) recorded precipitation data from 1997 through 2002, using a TSS literature value of 150 mg/L (Horner et al. 1994).

B. SEDIMENT SOURCES AND CONTRIBUTIONS

This source analysis shows that agricultural tailwater is the primary sediment source to the subject drains. Dredging is another major sediment source. Natural sources (in-stream erosion and wind deposition) and farmland runoff are relatively insignificant sediment sources.

Urban runoff and National Pollutant Discharge Elimination System (NPDES) facilities are not sediment sources. NPDES facilities do not discharge into the subject drains. Urban communities are too far from the subject drains to impact them. Niland, Calipatria, and Westmorland are the closest communities (2 or more miles) to the subject drains (MapQuest 2003). Urban runoff from these communities drains into the New River or other agricultural drains before reaching the subject drains.

An analysis of each sediment source is described below.

Agricultural Tailwater
Agricultural tailwater is a major sediment source, and the primary sediment source, to the subject drains. This is because nearly 100% of the subject drains' water originates from agricultural return flows, within which tailwater is the major source (48%) of flow volume (Jensen and Walter 1997). Agricultural return flows are also composed of tilewater, seepage, and operational spills, but these water sources are relatively sediment-free, and serve to dilute sediment concentrations. Tailwater is applied irrigation water that does not percolate into soil, thereby exiting at the lower end of the field, into an IID drain. Tailwater tends to erode a field as water flows across the surface, acquiring silt and sediment on the way into a drain.

Average TSS concentration in the subject drains is approximately 418 mg/L. This corresponds to a tailwater contribution of 29,545 tons/year to the subject drains. Table 7 shows the present average annual flow, average TSS, and average annual sediment load for the subject drains.

Table 7: Existing Flow, TSS, and Load for All Drains

Drain Name	Flow Average (AFY)	TSS Average (mg/L)	Sediment Load Average (tons/year)
Niland 2	1,264	410	705
P	2,688	235	859
Pumice	47,991	610	39,804
All Drains	**51,943**	**418**	**29,545**

Dredging
Dredging is a major sediment source to the subject drains. Many drains require periodic dredging to maintain adequate drainage, due to sediment loads received from agricultural fields. Dredging removes about 2,467 tons/year of sediment from the subject drains:

51,943 AFY x 0.007 x 5,000 mg/L x 0.0013597 = 2,467 tons/year

where: 51,943 AFY = total flow for the subject drains
0.007 = percentage (in decimal form) of Imperial Valley drains that are dredged at any particular time
5,000 mg/L = TSS concentration downstream of a dredging event
0.0013597 = conversion factor from mg/L to tons/year
2,467 tons/year = amount of sediment removed by dredging in the subject drains

Some of this sediment becomes suspended into the water, though the amount is unknown.

Natural Sources (In-Stream Erosion and Wind Deposition)
Natural sources are a relatively insignificant sediment source to the subject drains. Local soils are mostly colloidal clays and silts (Table 8). These soils tend to be cohesive, and therefore not easily eroded by water or wind. Width and depth of channels remain relatively constant from year to year.

Table 8: Imperial Valley Soil Associations

Soil Association	Description	Composition	Slope	Permeability
Imperial	Moderately well-drained silty clay. Very deep, calcareous soils. Natural drainage has been altered by irrigation canal seepage and extensive irrigation.	85% Imperial soils 15% minor soils	< 2%	Low
Imperial-Holtville-Glenbar	Moderately well-drained silty clay, silty clay loam, and clay loam. Very deep calcareous soils. Natural drainage has been altered by irrigation canal	40% Imperial soils 20% Holtville soils 20% Glenbar soils	< 2%	Low

	seepage and extensive irrigation.	20% minor soils		
Meloland-Vint-Indio	Well-drained fine sand, loamy very fine sand, fine sandy loam, very fine sandy loam, loam and silt loam. Very deep, calcareous soils. Natural drainage has been altered by irrigation canal seepage and extensive irrigation.	30% Meloland soils 25% Vint soils 20% Indio soils 25% minor soils	<2%	Low

(Zimmerman 1981)

In-stream (i.e., in-drain) erosion also is limited because: (a) water flow is relatively slow and stable due to terrain flatness and the presence of weirs and/or drop structures, and (b) portions of drain channel banks are vegetated. Wind deposition also is limited because: (a) the channel bank area exposed to wind is relatively small, and (b) most wind-blown "sand" is likely to settle on land, as the watershed has substantially more land surface area than water surface area. Natural sources contribute an estimated 10 mg/L of TSS, which corresponds to 106 tons per year.

Farmland Runoff

Farmland runoff is a relatively insignificant sediment source to the subject drains. The following analysis supports this conclusion.

A total of 10,463 acres of farmland drain into the subject drains. However, the Imperial Valley has an arid climate (about 3 inches of rain per year). Therefore, potential stormwater runoff from farmland can be disregarded except for areas that were being irrigated just before, during, and just after the storm[2]. About 5% of Imperial Valley farmland is irrigated on any given day (Bali 2000). Therefore, about 523 acres are irrigated on any given day in the study area (5% of 10,463 acres). This acreage potentially could generate farmland runoff, particularly if soils already were saturated. Table 9 summarizes the farmland runoff analysis.

Table 9: Farmland Runoff Summary

Year	Flow (AFY) from Farmland Runoff	% of Total Drain Flow	Load (tons/year) from Farmland Runoff	% of Total Drain Load
1997	159.1	0.3%	32.5	0.1%
1998	142.1	0.3%	29.0	0.1%
1999	87.6	0.2%	17.9	0.1%
2000	57.1	0.3%	11.7	0.1%
2001	72.8	0.2%	14.9	0.1%
2002	14.0	0.02%	2.9	0.01%
Annual	**88.8**	**0.2%**	**18.2**	**0.1%**

[2] Valley farmers order water deliveries two days ahead of time, and may not be able to factor in precipitation (to reduce their water orders) if the storm was not forecast before the order.

Average				

Source: (California Department of Water Resources 1997-2002)

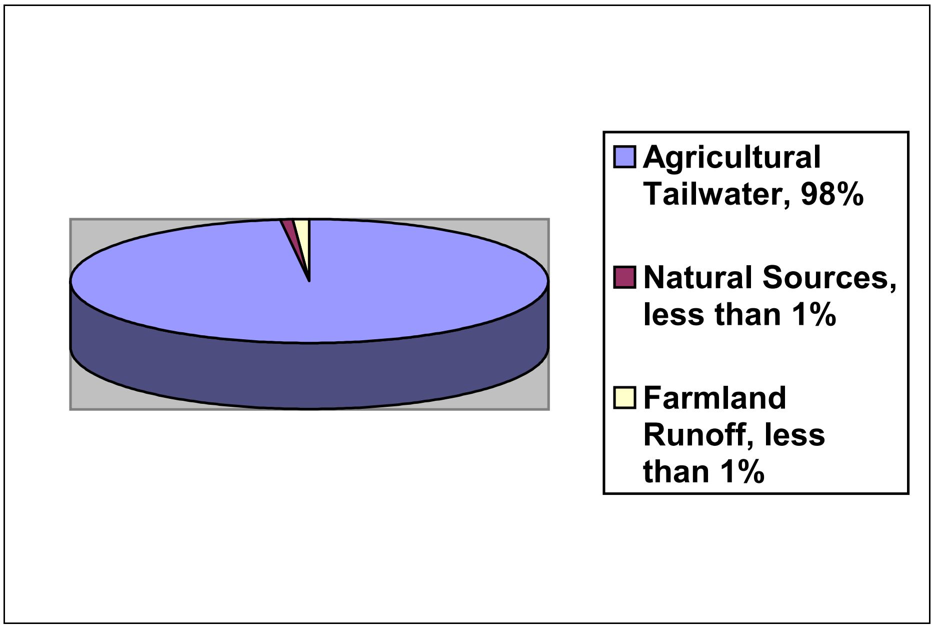
Summary of Sediment Sources

The source analysis is summarized numerically in Table 10, and graphically in Figure 2. Agricultural tailwater is the major source of sediment to the subject drains.

Table 10: Sediment Source Summary

Sediment Source	Flow (AFY)	Percent of Total Drain Flow	Sediment Load (tons/yr)	Percent of Total Drain Load
Agricultural Tailwater	51,943	99.8%	29,545	99.5%
Natural Sources	0	0%	106	0.4%
Farmland Runoff	89	0.2%	18	0.1%
All Sources	**52,032**	**100%**	**29,669**	**100%**

Figure 2: Sediment Source Summary - Percent of Total Drain Load



CRITICAL CONDITIONS/ SEASONALITY

This section describes the critical conditions/ seasonality that have the strongest impact on load conditions. Understanding such conditions is important in achieving TMDL goals.

A. DEFINITION

This TMDL determines the subject drains' assimilative capacity, and allocates loads to achieve water quality criteria. The critical condition is the set of environmental factors identified to ensure attainment of objectives under varying conditions. The critical condition typically is the time period (season) that the waterbody is most vulnerable, often due to changes in land usage or weather.

B. LOCAL WEATHER

The Imperial Valley drains are located in Imperial Valley, within Imperial County, California. The drains are in the Colorado Desert region of the Sonoran Desert. The climate is hot, with warm winters, dry summers, occasional thunderstorms, and gusty high winds with sandstorms. The area is one of the most arid in the United States, with an average annual rainfall of about three inches and temperatures in excess of 100ºF for more than 100 days per year. Average temperature is 54ºF in January, and 92ºF in July. Imperial Valley evapotranspiration rates can exceed 84 inches per year, and can be one-third inch per day in hot summer months. Therefore, climate is relatively stable throughout the year, without the wide swings in temperature and water found in other parts of the country.

C. LOCAL WATER FLOW

Imperial Valley drains are owned and operated by the Imperial Irrigation District (IID), which uses a 1,668-mile system of main and lateral canals to deliver water to 500,000 acres of Imperial Valley farmland (Imperial Irrigation District 1998). Nearly all (98%) of IID-transported water is used for agriculture, with a relatively small amount (2%) used for drinking water for nine Imperial Valley cities (Imperial Irrigation District 1998).

Irrigation activities are less frequent during the winter months when temperatures and evapotranspiration are lowest. Therefore, less water is diverted into the canals and flows are lowest during the winter months.

D. IDENTIFIED CRITICAL CONDITIONS/ SEASONALITY

There are no obvious critical conditions/ seasonality in regards to sediment in the subject drains. Water flow and climate are relatively stable. Sediment becomes suspended in tailwater regardless of the season.

LINKAGE ANALYSIS

This section describes the relationship between the numeric target, sediment sources, allocations, and assimilative capacity.

Water flow and sedimentation rates in the subject drains are relatively uniform and stable. This allows for relatively simple linkages between the numeric target, sediment sources, and allocations.

About 99% of water flow into the subject drains is from agricultural discharges. Significant settling of sediment does not occur in the subject drains because local soils are colloidal clays and silt, and fine sands. The particle size of these soil types is small. Therefore, a majority of sediments that enter the subject drains are expected to travel the entire drain length to the outlet at the Salton Sea.

The subject drains' assimilative capacity for sediment is defined as the highest sediment load that the drains can assimilate without exceeding the numeric target. Therefore, assimilative capacity is based on the numeric target, which is expressed as a concentration (mg/L). To determine assimilative capacity, the numeric target concentration must be converted to a sediment load (tons per year) based on the amount of water flow, while also accounting for natural sources and a margin of safety. The allowable sediment load includes load allocations, wasteload allocations, and future growth. Assimilative capacity for any time period can be expressed mathematically as:

Assimilative Capacity = Allowable Sediment Load + Natural Sources Load + Margin of Safety Load

Therefore, assimilative capacity of the subject drains (detailed calculations are in Appendix B) is:

Assimilative Capacity = 12,712.3 + 106.3 + 106.3 = 12,924.9 tons per year

These allocations, when achieved, are expected to result in suspended sediment concentrations that are within the assimilative capacity of the subject drains, thus achieving the numeric target.

ALLOCATIONS

This section quantifies and allocates the amount of sediment reduction required to attain Water Quality Standards. Allocations are:

(a) best estimates based on data availability and appropriate prediction techniques (40 CFR 130.2(g))
(b) required for all nonpoint sources, such as agricultural drains (40 CFR 130.2(g)).

A. METHODOLOGY

The allowable load was distributed among sediment sources, and included a margin of safety to account for uncertainty, as recommended by the U.S. Environmental Protection Agency's TMDL Guidelines (U.S. Environmental Protection Agency 1991). Therefore, a TMDL is the sum of load allocations for nonpoint sources (e.g., agricultural drains), individual wasteload allocations for point sources (e.g., wastewater treatment plants), natural sources (e.g., in-stream erosion and wind deposition), and a margin of safety. This can be represented by the following formula:

TMDL = Load Allocations + Wasteload Allocations + Natural Sources + Margin of Safety

Allocations were based on the Source Analysis and Numeric Target of this TMDL. Calculations were conducted by subtracting the natural sources allocation and margin of safety from the numeric target (in terms of concentration in mg/L). The allocation for human-made sources (e.g., the drains) was then distributed among the remaining allowable load. Methodology for each allocation is described below in more detail.

Load Allocations for Nonpoint Sources
The load for each drain was based on the drain's proportion of flow to the total flow. This equitably allocates the load among drains because drains with a higher flow tend to serve more acreage and thus carry a higher sediment load. Similarly, drains with a lower flow tend to serve less acreage and thus carry a lower sediment load. All calculations were then converted from concentration (in mg/L) to load allocations (in tons/year).

Wasteload Allocations for Point Sources
Point sources (e.g., wastewater treatment plants) do not discharge into the subject drains. However, an allocation for point sources has been included to account for potential future growth (i.e., more municipal wastewater services for an increased population). A larger population would mean more wastewater discharge, which would be handled through wastewater treatment plants (WWTPs). WWTPs are permitted, and thus required to meet a sediment standard in their discharge. Therefore, any discharge from future WWTPs into the subject drains would dilute sediment concentrations because WWTP discharge has relatively little sediment in comparison to agricultural runoff.

A wasteload allocation was established to serve as an unallocated reserve for future growth, and was set at 3% of the total load of the drains. This percentage reflects local population projections, and was based on figures from the New River Silt TMDL, where future growth accounted for 3% of the total load.

Natural Sources
The natural sources concentration was estimated to be 10 mg/L.

Margin of Safety
The margin of safety concentration was estimated to be 10 mg/L, equal to the natural source concentration. Therefore, if the actual natural sources load is up to double the estimated load, then the margin of safety will ensure that the numeric target is met.

B. SPECIFIC ALLOCATIONS BY SOURCE

Table 11 summarizes load allocations for nonpoint sources, which are distributed among the Niland 2 drain, P drain, Pumice drain, future growth, natural sources, and margin of safety. Detailed calculations are in Appendix B.

Table 11: Load Allocations Summary

Sediment Source	# of Drains Included in Segment	Sediment Load Allocation (tons/year)
Niland 2 drain	1	300
P drain	1	638
Pumice drain (including 5 Vail drains that drain into it)	6	11,393
Future Growth	None	381
Total Load Allocation for drains @ TSS = 180 mg/L	**8**	**12,712**
Natural Sources	Not applicable	106
Margin of Safety	Not applicable	106
Total Load Allocation for other sources @ TSS = 20 mg/L	**Not applicable**	**212**
TOTAL ASSIMILATIVE CAPACITY (Total Allocation for all sources @ TSS = 200 mg/L)	**8**	**12,924**

C. WATER TRANSFER PROPOSALS

Imperial Irrigation District (IID) water deliveries could decrease as much as 300,000 acre-feet/year (AFY) because of potential water transfers between IID and other water agencies (e.g., San Diego County Water Authority). Transferred water would be irrigation water "conserved" by IID and Imperial Valley farmers.

Decreased irrigation deliveries result in the same concentration, but a lower load, due to decreased water flow. The corresponding flow in the subject drains would be 35,044 AFY, assuming that the 300,000 AFY irrigation delivery reduction will result in an equal decrease in total drain flow as a worst-case scenario. The calculation follows below:

subject drain total flow - (water transfer loss x (subject drain total flow / IID total flow)

51,943 – (300,000 x (51,943 / 992,122) = 35,044 AFY

The corresponding load in the subject drains would be 19,932 tons/year, as opposed to the 29,545.2 tons/year now with the current flow. The calculation follows below:

flow x TSS x conversion factor

35,044 x 418.3 x .0013597 = 19,932 tons/year

IMPLEMENTATION PLAN

A. DISCHARGERS AND RESPONSIBLE PARTIES

All waste dischargers are responsible for their waste quality and for ensuring that discharges do not adversely impact beneficial uses of waters of the State. For this TMDL, dischargers include the Imperial Irrigation District, farm landowners, renters/lessees, and operators/growers discharging or potentially discharging wastes into waters of the State.

Imperial Irrigation District (IID)
IID is the largest stakeholder within the project area. IID operates and maintains irrigation canals and agricultural drains, including the subject drains.

Farm Landowners, Renters/Lessees, and Operators/Growers
Landowners have discretionary control of their land, and therefore have ultimate responsibility to control practices on their lands. Landowners ultimately are responsible for cleanup regarding renter/lessee practices. Renters/lessees also have responsibility for pollution control, as they have day-to-day control of farming operations.

Operators/growers are dischargers, as they have day-to-day control over farming operations and waste discharges. Operators/growers are defined as IID agricultural water account holders who purchase water from IID to irrigate farmland and, as a result, are likely to discharge waste into waters of the State.

B. THIRD PARTY COOPERATING AGENCIES AND ORGANIZATIONS

Cooperating agencies and organizations have technical expertise and resources that facilitate effective implementation of practices to address sediment pollution.

University of California Cooperative Extension, Holtville Field Station
The University of California Cooperative Extension (UCCE) offers workshops, programs, training courses, and technical assistance to growers on a broad range of agricultural topics. The UCCE Holtville Field Station conducts demonstration projects and research for erosion control.

U.S. Department of Agriculture Natural Resources Conservation Service (NRCS)
The federal Natural Resources Conservation Service (NRCS) provides technical aid in securing financial assistance to support implementation of Best Management Practices (BMPs). The *Field Office Technical Guide* (Natural Resources Conservation Service 1996) contains technical standards and specifications of BMPs.

Imperial County Farm Bureau
The Imperial County Farm Bureau (ICFB) initiated a Voluntary Watershed Program to conduct outreach programs and to foster effective self-determined attainment of TMDL loads. Specific goals of the Voluntary Watershed Program include:

- coordination of workshops with local technical assistance agencies
- provision of demonstration sites for BMP field-testing
- cooperation with Regional Board staff to track and report BMP effectiveness

C. BEST MANAGEMENT PRACTICES

Best Management Practices (BMPs) are methods applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters. Sediment-control BMPs work by limiting irrigation water velocity and making the field more resistant to erosive forces. Effectiveness of sediment BMPs can be increased greatly when different BMPs are used together (Kalin 2003).

Landowners/operators are the best parties to identify which BMPs are most appropriate for TMDL attainment, based on site-specific and crop-specific conditions. Technical resource agencies and organizations may be of assistance.

Public Involvement in BMP Identification and Development

During TMDL development, the Technical Advisory Committee formed an On-Field Sediment BMP Subcommittee who prepared a list of recommended BMPs (Appendix C). Additionally, the UCCE submitted a list of recommended BMPs (Appendix D). Regional Board staff evaluated both lists and discussed BMPs with TMDL TAC members at three TAC meetings, during which language revisions were made. Those changes are incorporated herein.

On-Field Sediment-Control BMPs

The following are on-field, sediment-control BMPs (references are in brackets):

- **Maintenance of Field Drainage Structure (Imperial Irrigation District Regulation No. 39)**
  Imperial Irrigation District's Regulation 39 states, in part, "It is the responsibility of each water user to maintain a tailwater structure and approach channel in acceptable condition, in order to qualify for delivery of water. An acceptable structure shall have vertical walls and a permanent, level grade board set a maximum of 12 inches below the natural surface. If the situation warrants, and at the discretion of the district, 18 inches maximum may be allowed".

  {Imperial Irrigation District Regulation No. 39, Silt TMDL TAC, Consistent with Natural Resource Conservation Service (NRCS) Field Office Technical Guide (FOTG) Conservation Practice "Structure for Water Control" (Code 587), Consistent with Jones & Stokes BMP #1: Improved Drop Box}

- **Tailwater Drop Box with Raised Grade Board**
  This practice involves maintenance of the grade board at an elevation high enough to minimize erosion. In many situations, the grade board elevation can be set higher than required by IID regulations, especially when anticipated tailwater flows will not reach an elevation that will cause crop damage. Jones & Stokes (Jones & Stokes Associates 1996) rated this BMP as having a demonstrated positive sediment transport reduction effect and a relatively low cost.

  {Silt TMDL TAC, Consistent with NRCS FOTG Conservation Practice "Structure for Water Control" (Code 587), Consistent with Jones & Stokes BMP #1: Improved Drop Box}

- **Improved Drop Box with Widened Weir and Raised Grade Board**
  This practice involves widening the drop box overpour weir and maintaining the grade board at an elevation high enough to minimize erosion. Widening the drop box overpour weir

enables the weir elevation to be set higher without raising the surface elevation of water above the acceptable level. Higher weir elevations allow an increased tailwater ditch cross-section, and reduced erosion when water leaving the field enters the tailwater ditch. Jones & Stokes (Jones & Stokes Associates 1996) rated this BMP as having a demonstrated positive sediment transport reduction effect (sediment reduction efficiency of 40% to 60%) and a relatively low cost.

{Silt TMDL TAC, Consistent with NRCS FOTG Conservation Practice "Structure for Water Control" (Code 587), Jones & Stokes BMP #1: Improved Drop Box}

- **"Pan Ditch" -- Enlarged Tailwater Ditch Cross-section**
  This practice involves deepening and widening the tailwater ditch, which results in decreased tailwater velocity and depth. Water must be checked downstream of the oversized area to make the water cross-section as large as practical. The slower the velocity, the more sediment will settle out of the water and stay in the field, and the less will be picked up by moving water. The effectiveness of this BMP is further improved by planting grass filter strips in the tailwater ditch and/or installing tailwater ditch checks.

  {Silt TMDL TAC}

- **Tailwater Ditch Checks or Check Dams**
  Tailwater Ditch Checks are temporary or permanent dams that hold water level well above ground. They can be placed at intervals in tailwater ditches, especially those with steeper slopes. They increase the cross-section of the stream of water, decrease water velocity and reduce erosion, and may cause sediment already in the water to settle out. Tailwater Ditch Checks can be constructed of plastic, concrete, fiber, metal, or other suitable material. If plastic sheets are used, care must be taken not to allow plastic pieces to be carried downstream with water. In order to be effective, this BMP must be utilized where water velocities will not wash out check dams or sides of the tailwater ditch around the dams. Tailwater ditch checks or check dams are expected to work best in wide "pan ditches" where tailwater stream width can be increased effectively. Jones & Stokes (Jones & Stokes Associates 1996) rated this BMP as having a likely positive effect on sediment transport reduction and a relatively low cost.

  {Silt TMDL TAC, Jones & Stokes BMP #2: Portable Check Dams}

- **Field to Tailditch Transition**
  This practice involves controlling water flow from the field into the tailwater ditch through spillways or pipes without washing across and eroding soil. Spillways might be constructed of plastic, concrete, metal, or other suitable material. If plastic sheets are used, care must be taken not to allow plastic pieces to be carried downstream with water. This procedure may be useful on fields irrigated in border strips and furrows. Care must be taken to address erosion that may be caused where the spillway discharges to the tailditch.

  {Silt TMDL TAC}

- **Furrow Dikes (also known as "C-Taps")**
  Furrow dikes are small dikes created in furrows to manage water velocity in the furrow. They can be constructed of earth and built with an attachment to tillage equipment, pre-manufactured "C-Taps," or other material, including rolled fiber mat, plastic, etc. Jones &

Stokes (Jones & Stokes Associates 1996) rated this BMP as having a likely positive sediment transport reduction effect and a relatively low cost.
{Silt TMDL TAC}

- **Filter Strips**
  This practice involves border elimination on the field's last 20 to 200 feet. The planted crop is maintained to the field's end, and tailwater from upper lands is used to irrigate the crop at the ends of adjacent lower lands. The main slope on the field's lower end should be no greater than on the balance of the field. A reduced slope might be better. With no tailwater ditch, very little erosion occurs as water slowly moves across a wide area of the field to the tailwater box. Some sediment might settle out as the crop slows the water as it moves across the field. This could be used with water-tolerant crops or special soil conditions. Jones & Stokes (Jones & Stokes Associates 1996) rated this BMP as having a demonstrated positive sediment transport reduction effect (sediment reduction efficiency of 40% to 65%) and a relatively low to medium cost.

  {Silt TMDL TAC, Consistent with NRCS FOTG Conservation Practice "Filter Strip" (Code 393), Jones & Stokes BMPs #4: Filter Strips}

- **Irrigation Water Management**
  Irrigation water management is defined as determining and controlling irrigation water rate, amount, and timing in a planned manner. Effective implementation can result in minimizing on-farm soil erosion and subsequent sediment transport into receiving waters. Specific irrigation water management methods include: surge irrigation, tailwater cutback, irrigation scheduling, and runoff reduction. In some cases, irrigation water management could include employment of an additional irrigator to better monitor and manage irrigation water and potential erosion.

  {Consistent with NRCS FOTG Conservation Practice "Improved Water Application" (Code 197, CA Interim), Consistent with NRCS FOTG Conservation Practice "Irrigation Water Management" (Code 449), Jones & Stokes BMPs #8: Improved Irrigation Scheduling, #9: Gated Pipe Irrigation, #11:Cut-Back Irrigation, #12: Cablegation, #15: Surge Irrigation}

- **Irrigation Land Leveling**
  This practice involves maintaining or adjusting field slope to avoid excessive slopes or low spots at a field's tail end. It might be advantageous in some cases to maintain a reduced main or cross slope, which facilitates more uniform distribution of irrigation water and can result in reduced salt build-up in soil, increased production, reduced tailwater, and decreased erosion. Jones & Stokes (Jones & Stokes Associates 1996) rated this BMP as having a sediment reduction efficiency of 10% to 50%, and a medium to high cost.

  {Silt TMDL TAC, Consistent with NRCS FOTG Conservation Practice "Irrigation Land Leveling" (Code 464), Jones & Stokes BMPs #13 and #14: Land Leveling, Slope Adjustments, Tail End Flattening, and Dead Leveling}

- **Sprinkler Irrigation**
  Sprinkler irrigation involves water distribution by means of sprinklers or spray nozzles. The purpose is to apply irrigation water efficiently and uniformly to maintain adequate soil moisture for optimum plant growth without causing excessive water loss, erosion, or reduced water quality. Jones & Stokes (Jones & Stokes Associates 1996) rated this BMP as having a demonstrated positive sediment transport reduction effect (sediment reduction efficiency

of 25% to 35% if utilized during germination, and 90% to 95% for an established crop), and a relatively high cost.

{Consistent with NRCS FOTG Conservation Practice "Irrigation System, Sprinkler" (Code 442), Jones & Stokes BMPs #17 and #18: Irrigation Sprinkler Systems}

- **Drip Irrigation**
  Drip irrigation consists of a network of pipes and emitters that apply water to soil surface or subsurface in the form of spray or small stream.

- **Reduced Tillage**
  This practice involves elimination of at least one cultivation per crop. It integrates weed control practices to maximize effectiveness, but minimizes erosion and sedimentation that may occur in the furrow.

Off-Field Sediment Control BMPs
The following are off-field sediment-control BMPs (references are in brackets):

- **Channel Vegetation / Grassed Waterway**
  This practice involves establishing and maintaining adequate plant cover on channel banks to stabilize channel banks and adjacent areas, and to establish maximum side slopes. This practice reduces erosion and sedimentation, thus reducing bank failure potential.

  {Consistent with NRCS FOTG Conservation Practice "Channel Vegetation" (Code 322), and NRCS FOTG Conservation Practice "Grassed Waterway" (Code 412)}

- **Irrigation Canal or Lateral**
  This practice applies to irrigation drainage channels. One objective is to prevent erosion or water quality degradation. Drainage channels should be designed to develop velocities that are non-erosive for the soil materials from which the channel is constructed.

  {Consistent with NRCS FOTG Conservation Practice "Irrigation Canal or Lateral" (Code 320)}

- **Sedimentation Basins**
  Sedimentation basins collect and store debris or sediment. Sedimentation basin capacity should be sufficient to store irrigation tailwater flows long enough to allow most sediments within the water to settle out. Sedimentation basins also must be cleaned regularly to maintain capacity and effectiveness.

Effectiveness Monitoring
Effectiveness monitoring (also known as management monitoring) is used to evaluate effectiveness of a BMP/management practice or set of BMPs/management practices. Effectiveness monitoring should be implemented in conjunction with technical assistance (e.g., UCCE) to ensure that data will be useful.

There is currently a lack of quantitative data on performance of applicable BMPs under local conditions. Performance data will be considered in future TMDL revisions. Regional Board staff will work cooperatively with ICFB and IID to determine appropriate monitoring protocols and tracking/reporting protocols to assess BMP performance.

D. TIERED IMPLEMENTATION APPROACH TO ACHIEVE TMDL COMPLIANCE

TMDL implementation involves a three-tiered approach to nonpoint source (NPS) pollution control, consistent with the State's NPS Management Plan (State Water Resources Control Board 1988). Tier 1 is implementation of self-determined best management practices. Tier 2 is regulatory-encouraged best management practices. Tier 3 is effluent limitation that could lead to enforcement actions due to non-compliance. The Regional Board is not required to sequentially move through tiers (e.g., Tier 1 to Tier 2 to Tier 3), and may move directly to Tier 3. The Regional Board also may implement a combination of mechanisms from each tier, as provided under the CWC.

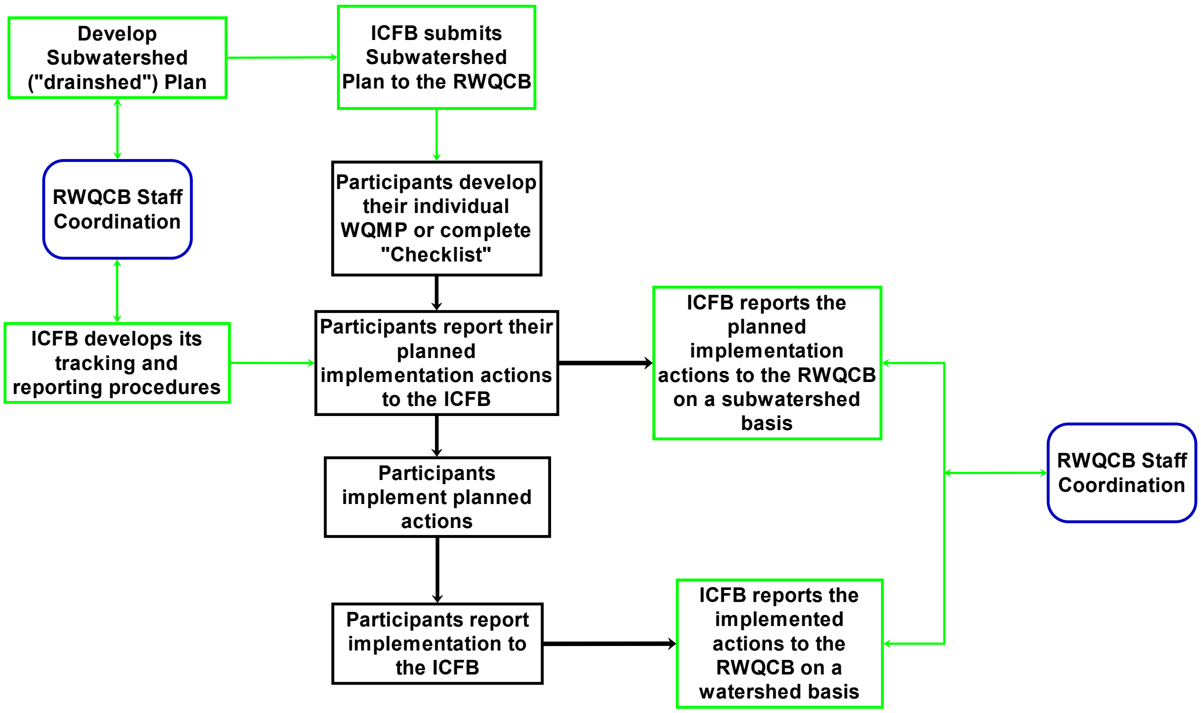
Tiers 1 and 2 contain requirements similar to those contained in the Alamo and New River Sedimentation/Siltation TMDLS. Stakeholders who already have complied with the requirements of those TMDLS are not required to re-submit reports, workplans, or other information already submitted to the Regional Board. Stakeholders who are subject to multiple TMDLs are encouraged, but not required, to combine submissions so that a single report or workplan satisfies the requirements of all applicable TMDLS.

Tier 1 – ICFB Voluntary Watershed Program

The California Farm Bureau Federation and Imperial County Farm Bureau (ICFB) have taken a proactive approach to educate and encourage farmers to develop and implement self-determined BMPs for sediment control through the Voluntary Watershed Program. Regional Board staff fully supports this approach and will work closely with ICFB to: (a) track BMP implementation and effectiveness, (b) develop and implement subwatershed water quality monitoring programs, and (c) provide regulatory guidance as needed.

ICFB is required to submit to the Regional Board a list of participants in its Voluntary Watershed Program by September 28, 2003. It is expected that program participants cooperatively will develop subwatershed plans, further develop Farm Water Quality Management Plans, report planned implementation actions and time-bound milestones to ICFB, and report completed implementation actions to ICFB. ICFB then will report to the Regional Board the planned implementation actions, time-bound milestones, and completed implementation actions on a subwatershed basis (not on a field-by-field or operator-by-operator basis). Figure 3 depicts ICFB and Regional Board interaction.

Figure 3: Interaction Between ICFB Voluntary Watershed Program and Regional Board



Regarding the Watershed Program Plan, ICFB should:

a. By <u>one month after Office of Administrative Law (OAL) approval of this TMDL</u>**, issue letters to all potential program participants within the project area that are enrolled in the ICFB Voluntary Watershed Program, informing them that the TMDL is being implemented and stating what is required of them.

b. By <u>one month after OAL approval of this TMDL</u>**, submit the ICFB Watershed Program Plan to the Regional Board. The Plan should: (1) identify measurable environmental and programmatic goals; (2) describe aggressive, reasonable milestones and timelines for development and implementation of TMDL outreach plans; (3) describe aggressive, reasonable milestones and timelines for development of subwatershed ("drainshed") plans; and (4) describe a commitment to develop and implement a tracking and reporting program.

c. By <u>one month after OAL approval of this TMDL</u>**, provide the Regional Board with a list of program participants, organized by subwatershed ("drainshed").

** Implementation of this program has begun, via the Alamo River and New River TMDLs.

d. Submit semi-annual reports to the Regional Board's Executive Officer that describe: (1) progress of each subwatershed group, (2) planned or conducted technical assistance workshops, and (3) any other pertinent information.

Regarding procedures for tracking and reporting, ICFB should:

a. By <u>one month after OAL approval of this TMDL</u>**, submit a plan to the Regional Board's Executive Officer describing tracking and reporting processes and procedures for: (1) implementation of BMPs and other proven management practices, and (2) BMP performance.

b. Implement the tracking and reporting procedures in accordance with the Implementation Plan.

c. Submit a yearly summary report to the Regional Board's Executive Officer by February 15th of each year.

If ICFB does not develop plans and mechanisms in accordance with the schedule set herein, the Regional Board will need to consider Tier 2 and Tier 3 regulatory approaches for individual dischargers.

Tier 1 – Approved Self-Determined TMDL Watershed Programs
Farm landowners, renters/lessees, or operators/growers not participating in the ICFB Voluntary Watershed Program must submit self-determined sediment control programs to the Regional Board by <u>one month after OAL approval of this TMDL</u>**. A sediment control program may be submitted by an individual operator/grower (Individual Program) or by a group of operators/growers (Group Program). Reported BMP implementation is submitted to the Regional Board under penalty of perjury. The sediment control program must address the following:

1. Farm owner name, business address, mailing address, and phone number.
2. Farm operator/grower name, business address, mailing address, and phone number.
3. Problem assessment, including site conditions, crops, potential or current NPS problems, problem severity, and problem frequency.
4. Goal statement, including measurable outcomes or products.
5. Existing and/or alternative sediment management practices, including technical/economic feasibility, and desired outcome.
6. Implementation timetable for management practices, measured in water quality improvement and/or implementation level.
7. Monitoring, including progress toward goals and management decision effectiveness.
8. Mechanism for reporting planned and completed implementation actions to the Regional Board. A group may provide a single monitoring and reporting plan as long as results are representative of the efficiency of the group's various control practices, in order to measure overall water quality improvements.

** Implementation of this program has begun, via the Alamo River and New River TMDLs.

Additionally, a Group Program must provide information on a drain- or drainshed basis regarding which responsible parties are enrolled in the program.

At the request of responsible parties or groups furnishing a program, program portions that might disclose trade secrets shall not be made available for public inspection, but shall be made available to governmental agencies for use in determining further studies (CWC Section 13267(b)(2)). These program portions shall be available for use by the Regional Board or any state agency in judicial review or enforcement proceedings involving the person or group that furnished the report.

Tier 2 – IID Drain Water Quality Improvement Program
In 1994, the Regional Board's Executive Officer requested IID take "accelerated action to address degraded water quality conditions in Imperial Valley drainage ways." In response, IID submitted its Drain Water Quality Improvement Plan (DWQIP). The DWQIP was established in 1994 as Tier 2/regulatory-based encouragement for nonpoint source pollution control. IID implemented short-term demonstrations of BMPs to reduce sediment runoff and implemented a monitoring program in agreement with Regional Board staff from 1996 through 1997. The DWQIP was suspended in 1999 upon recommendation of Regional Board staff so that the DWQIP could be revised to meet the needs of the TMDL process.

The Alamo River Sedimentation/Siltation TMDL requires IID to submit a revised DWQIP by September 28, 2003 that includes proposed comprehensive water quality monitoring, sediment control measurements, monitoring time schedules, and implementation assurances. The New River Sedimentation/Siltation TMDL requires IID to submit this information for the New River watershed by May 31, 2004. By <u>one month after OAL approval of this TMDL**</u>, IID must submit the same information for the Imperial Valley Drains watershed. Sediment-control measures must focus on operation and maintenance impacts (e.g., dredging, vegetation removal, blown tailwater discharge pipes). More specifically, IID must submit to the Regional Board a revised DWQIP with a proposed program to control and monitor water quality impacts caused by Imperial County river/ drain maintenance and dredging operations. The revised DWQIP is subject to Regional Board Executive Officer approval and must address, but need not be limited to, Items 1 and 2, below:

1. Drain Maintenance and Dredging Controls

   The revised DWQIP must consist of:

   - Control measures to ensure that drainage maintenance operations do not cause TMDL exceedance. These measures must include: (a) seasonal restrictions to avoid impacts on sensitive resources, and (b) certified CEQA documents should the practices fall outside the scope of this TMDL.
   - Timelines for implementation of control practices.
   - Mechanisms to assess performance of control practices.

** Implementation of this program has begun, via the Alamo River and New River TMDLs.

2. Drain Water Quality Monitoring Plan

   The revised DWQIP must consist of:

   - Water quality and habitat impacts caused by drain dredging operations.
   - Representative water column samples (taken from the last drain weir before the outfall) from all major drains and a statistically representative number from small drains tributary to the Salton Sea, for analyses of flow, TSS, turbidity, selenium, total organic carbon, nutrients, persistent pesticides (e.g., DDT and metabolites), pesticides applied by irrigation practices (e.g., ETPC), pesticides used as pre-emergents and post-emergents by crop and season, and pesticides used for drain and channel weed control (e.g., diuron).
   - A statistically representative number of irrigation water locations, for TSS
   - A statistically representative number of drains located sufficiently upstream of outfalls, to determine how much silt is reduced by field BMPs
   - Sediment impacts from storm events

Also, no later than <u>one month after OAL approval of this TMDL</u>**, and on a semi-annual basis thereafter, IID must submit to the Regional Board the following information on agricultural dischargers within the District:

- Names and mailing addresses of all property owners engaged in irrigated agriculture within the IID service area, and property locations.
- Names and mailing addresses of all water account holders within the IID service area, and irrigated field locations.
- For each parcel within the IID service area, the parcel location, irrigation canals and gates serving the parcel, drop boxes draining the parcel, drains that these drop boxes empty into, and fields within each parcel.
- For each field within the IID service area, the parcel within that each field is located within, area and location of each field within the parcel, irrigation canals and gates serving each field, drop boxes draining each field, and drains that these drop boxes empty into.

To the extent practical, the above information should be submitted in an electronic, tabular, and easily geo-referenced format.

Further, no later than 60 days following Regional Board Executive Officer approval of the revised DWQIP, the IID must submit to the Executive Officer for approval a Quality Assurance Project Plan (QAPP) for the revised DWQIP, prepared in accordance with *Requirements for Quality Assurance Project Plans for Environmental Data Operations*, EPA QA/R-5 (U.S. Environmental Protection Agency 2001). No later than 30 days following Regional Board Executive Officer approval of the QAPP, the IID must implement the QAPP and submit monthly, quarterly, and annual monitoring reports to the Executive Officer. Monthly reports are due on the 15th day of the month and must transmit the previous month's monitoring results, progress towards implementation of control practices, and performance of control practices. Quarterly

** Implementation of this program has begun, via the Alamo River and New River TMDLs.

reports are due on the 15th day of the month following the calendar's quarter and must transmit a quarterly summary of results for the previous three months. Annual reports are due on February 15 and must summarize the year's data, quality control reports, and any data trends.

Tier 3 – NPS Recalcitrant Violators
Aggressive enforcement is necessary for responsible parties who fail to implement self-determined or regulatory-encouraged sediment control measures. To this end, the Regional Board may use any of the following:

- Implementation and enforcement of CWC §13225, 13267, and 13268 to ensure that all responsible parties submit, in a prompt and complete manner, the Water Quality Management Plan defined above.

- Require submission of reports of waste discharge pursuant to CWC §13260.

- Adoption of waste discharge requirements, pursuant to CWC §13263, for any responsible party who fails to implement voluntary or regulatory-encouraged sediment controls.

- Adoption of enforcement orders pursuant to CWC §13304 against any responsible party who violates Regional Board waste discharge requirements and/or fails to implement voluntary or regulatory-encouraged sediment control measures to prevent and mitigate sediment pollution or threatened pollution of surface waters.

- Adoption of enforcement orders pursuant to CWC §13301 against any responsible party who violates Regional Board waste discharge requirements and/or prohibitions.

- Issuance of Administrative Civil Liability Complaints, pursuant to CWC §13261, 13264, or 13268 against any responsible party who fails to comply with Regional Board orders, prohibitions, and requests.

- Adoption of referrals of recalcitrant violators of Regional Board orders and prohibitions to the District Attorney or Attorney General for criminal prosecution or civil enforcement.

In assessing the compliance of any responsible party, Regional Board staff recommends that the Regional Board consider water quality results and the degree to which the responsible party is implementing sediment-control measures.

E. ADAPTIVE MANAGEMENT COMMITTEE

The Regional Board Executive Officer will establish an Adaptive Management Committee (AMC) comprised of stakeholder representatives and agencies. The AMC will meet at least semi-annually. Regional Board staff will provide AMC with formal results of water quality monitoring and tracking. AMC will evaluate overall BMP implementation and performance, evaluate water quality improvements, and make appropriate recommendations for TMDL compliance and/or modification. IID and ICFB will have the opportunity to report their progress toward attainment of milestones set forth in this TMDL and in plans submitted by them pursuant to this Implementation Plan.

Proven BMPs currently are available to address sediment loading. Therefore, this Implementation Plan does not require a schedule for development of management practices. However, the AMC and/or subwatershed groups can prioritize BMPs for refinement and performance assessment, and can identify new management practices.

F. INTERIM NUMERIC TARGETS

The Regional Board's goal is attainment of TMDL allocations by the year 2013. The proposed implementation plan occurs in four phases, covering 10 years. This schedule is synchronous with the implementation schedule for the New River Sedimentation/Siltation TMDL. USEPA Guidance (U.S. Environmental Protection Agency 1991) allows for a phased approach for TMDL development and implementation when there is insufficient data. The numeric target, load allocations, waste load allocations, and margin of safety must be set when implementing a phased approach. However, these values may be modified based on new data. In the meantime, dischargers can implement procedures to reduce pollutant loadings. This TMDL requires additional data to determine load reduction adequacy and to better determine assimilative capacities and pollution allocations. Time-bound interim numeric targets are shown in Table 12.

Table 12: Interim Numeric Targets for TMDL Attainment

Phase	Time Period	Estimated Reduction*	Interim Target (mg/L)
Phase 1	2004 (Year 1)	20%	334
Phase 2	2005 through 2007 (Years 2 – 4)	25%	251
Phase 3	2008 through 2010 (Years 5 – 7)	15%	213
Phase 4	2011 through 2013 (Years 8 – 10)	6%	200

* Percent reductions indicate the reduction required in TSS at the beginning of each phase, starting with the current (2002) average concentration of 418 mg/L.

G. MONITORING AND TRACKING PROGRAM

It is important to track TMDL implementation, monitor water quality progress, and modify TMDLs and Implementation Plans as necessary because the Regional Board wants to:

- Address uncertainty that may have existed during TMDL development
- Oversee TMDL implementation to ensure that implementation is occurring
- Ensure TMDL effectiveness, given watershed changes that may have occurred after TMDL development

The Regional Board will conduct the TMDL Monitoring and Tracking Program pursuant to a Quality Assurance Project Plan (QAPP). The QAPP will be developed by Regional Board staff and will be ready for implementation within one month after Office of Administrative Law (OAL) approval of this TMDL**. Regional Board staff will perform two types of monitoring: (1) water quality monitoring, and (2) implementation tracking. Both are described below.

Water Quality Monitoring
Monitoring program objectives include:

- assessment of water quality objectives attainment
- verification of pollution source allocations
- calibration or modification of selected models (if any)
- calculation of dilutions and pollutant mass balances
- evaluation of point and nonpoint source control implementation and effectiveness
- evaluation of in-stream water quality
- evaluation of water quality temporal and spatial trends

The following parameters will be sampled, contingent on funding. Data sources may be outside of the Regional Board. Frequency is in brackets.

- Flow [Quarterly]
- Field turbidity [Monthly]
- Lab turbidity (EPA Method No. 180.1) [Monthly]
- Total Suspended Solids (EPA Method No. 160.2) [Monthly]
- Total DDT and DDT metabolites (EPA Method No. 8081) [Quarterly]

Implementation Tracking
Regional Board staff will develop a plan to track TMDL implementation, within one month after Office of Administrative Law (OAL) approval of this TMDL**. Objectives are to:

- Assess, track, and account for practices already in place
- Measure milestone attainment
- Report progress toward NPS water quality control implementation, in accordance with the State Board NPS Program Plan

I. MEASURES OF SUCCESS, AND FAILURE SCENARIOS

Measures of Success
The primary measure of success for TMDL implementation is attainment of interim numeric targets and corresponding interim load allocations, with attainment of final TMDL load allocations. Another measure of success may be the level of Tier 2 and Tier 3 compliance.

** Implementation of this program has begun, via the Alamo River and New River TMDLs.

Failure Scenarios

Two failure scenarios exist regarding TMDL implementation. The first is failing to meet water quality improvement goals (interim numeric targets and corresponding load allocations) coupled with *achievement* of implementation milestones. If this scenario materializes, BMPs and interim targets will be re-evaluated and adjusted. The second failure scenario involves failure to meet water quality improvement goals (interim numeric targets and corresponding load allocations) coupled with *failure* to achieve implementation milestones**.** If this scenario materializes, the Regional Board shall consider more stringent regulatory mechanisms.

H. TMDL REVIEW SCHEDULE

Annual Reports

Regional Board staff shall present yearly reports to the Regional Board describing progress toward milestone attainment. Reports will assess:

- Water quality improvement (in terms of total suspended sediments, total sediment loads, Total DDT, and DDT metabolites).
- BMP implementation trends and effectiveness.
- Whether milestones were met on time or at all. If milestones were not met, the reports will discuss reasons and make recommendations.
- Level of compliance with measures and timelines agreed to in Program Plans and Drainshed Plans.

Triennial Review

The first TMDL review is scheduled to conclude three years after TMDL approval to provide adequate time for implementation and data collection. Subsequent reviews will be conducted concurrently with the Basin Plan Triennial Review. The TMDL review schedule is shown in Table 13.

Table 13: TMDL Review Schedule*

Activity	Date
Approval	2004
Begin First Review	August 2004
End Review (Regional Board Public Hearing)	April 2005
Submit Administrative Record to State Board	May 2005
Begin Second Review	July 2006
End Review (Regional Board Public Hearing)	June 2007
Submit Administrative Record to State Board	July 2007
Begin Third Review	July 2009
End Review (Regional Board Public Hearing)	June 2010

Submit Administrative Record to State Board	July 2010
Etc.	

* Dates are contingent upon Regional Board adoption and State Board approval.

Regional Board staff proposes that the Regional Board hold public hearings at least every three years to review sediment-control progress. At these hearings, it is proposed that the Regional Board consider:

- monitoring results
- progress toward milestone attainment
- BMP implementation trends
- modification and/or addition of management practices for sediment discharge control
- revision of TMDL components and/or development of site-specific water quality objectives

PROPOSED AMENDMENT

The Proposed Basin Plan Amendment:

- Updates references to the State's Nonpoint Source Pollution Control Program
- Includes Regional Nonpoint Source Control Program elements
- Deletes dated information that is no longer accurate
- Establishes a numeric target of 200 mg/L of total suspended solids
- Adds a section for this proposed TMDL that:

    - Summarizes subject drains (Niland 2, P, and Pumice drains) Sedimentation/Siltation TMDL elements, including the Problem Statement, Numeric Target, Source Analysis, Margin of Safety, Critical Conditions/ Seasonality, Loading Capacity, and Load Allocations and Wasteload Allocations
    - Establishes interim numeric targets
    - Designates responsible parties and management actions
    - Lists recommended Best Management Practices (BMPs), with estimated implementation costs and financing sources
    - Describes recommended actions for cooperating agencies
    - Describes TMDL compliance monitoring and enforcement activities
    - Describes Regional Board water quality monitoring and implementation tracking activities to assess TMDL implementation
    - Describes public reporting activities
    - Describes the Regional Board review process

CONDITIONAL PROHIBITION

The Proposed Basin Plan Amendment will include a conditional prohibition of sediment discharge unless the discharge is either in compliance with applicable TMDL(s), including implementation provisions, or Waste Discharge Requirements (WDRs).

ECONOMIC IMPACTS

A. ECONOMIC IMPACT ASSESSMENT

The State Board Economics and Effectiveness Unit prepared an Economic Impact Assessment that evaluated costs of implementing Best Management Practices (BMPs) that reduce sediment/silt. Implementation of this TMDL probably will increase total production costs by less than 1% for field crops and vegetables. For non-vegetable row-crops, sediment retention costs represent about 2% of total production costs.

The estimated costs of sediment/silt reduction ranged from a high of just under $200,000 to a low of over $22,000 for the 10,463 acres that are drained by the subject drains. The high-cost scenario was based on installation of sediment ponds or synthetic fiber strips. The low-cost scenario was based on installation of grass strips. Average per acre costs ranged from just under $20 to over $2 per acre.

B. FEDERAL TECHNICAL AND FINANCIAL ASSISTANCE

U.S. Department of Agriculture's Natural Resources Programs
The Natural Resources Conservation Service (NRCS) offers landowners financial, technical, and educational assistance to implement conservation practices on privately-owned land. These programs include:

Environmental Quality Incentives Program -- offers financial, educational, and technical help to implement BMPs such as manure management systems, pest management, and erosion control, to improve environment health. Cost-sharing may pay up to 75% of costs of certain conservation practices.

National Conservation Buffer Initiative -- created to help landowners establish conservation buffers, such as riparian areas along rivers, streams, and wetlands.

Clean Water Act Section 319(h)
Federal NPS water quality implementation grants are available each year on a competitive basis. These grants range from $25,000 to $350,000 and require a 40% non-federal match. The Regional Board administers these grants.

Clean Water Act Section 205(j)
Federal water quality planning grants are available each year on a competitive basis. These grants range from $25,000 to $120,000 and require a 25% non-federal match. The Regional Board administers these grants.

C. STATE TECHNICAL ASSISTANCE

University of California Cooperative Extension Programs
U.C. Cooperative Extension offers technical assistance regarding BMPs and erosion control.

D. POTENTIAL FUNDING SOURCES

Potential funding sources include:

- Private financing by individual sources
- Bond indebtedness or loans from government institutions
- Surcharges on water deliveries to lands contributing to sediment pollution
- Taxes and fees levied by the IID for drainage management
- State and/or federal grants and low-interest loans
- Single-purpose appropriations from federal and/or state legislative bodies

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APPENDIX A

Silt TMDL Technical Advisory Committee

ITEM E-1: MEMBERS OF THE SILT TECHNICAL ADVISORY COMMITTEE

Representative Name	Agency/Organization/Affiliation
Birdsall, Stephen	Imperial County Agricultural Commissioner
Cagle, Fred	Audubon Society/Sierra Club
Christensen, Bart	State Water Resources Control Board
Friend, Milt	Salton Sea Science Subcommittee
Gilbert, Larry	Imperial Valley Farmer
Grizzle, Lauren	Imperial County Farm Bureau and Imperial Valley Vegetable Growers Association
Grubuagh, Elston	Imperial Irrigation District
Guerrero, Juan	University of California Cooperative Extension, Holtville Field Station
Johnson, Steve	Sonny Bono Salton Sea National Wildlife Refuge
Kalin, Al	Imperial Valley Farmer
Kirk, Tom	Salton Sea Authority
Lesicka, Leon	Desert Wildlife Unlimited, Inc.
McGrew, Ed	United States Filter Corporation
Menvielle, John-Pierre	Imperial Valley Farmer
Roberts, Carol	United States Fish and Wildlife Service
Robertson, Robert	Coachella Valley Water District
Rodriguez, Cheryl	United States Bureau of Reclamation
Snyder, Jennie	Imperial County Farm Bureau
Walker, James	Imperial Valley Farmer

ITEM E-2: BYLAWS OF THE SILT TMDL TAC

BYLAWS
of the
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD,
COLORADO RIVER BASIN REGION
TOTAL MAXIMUM DAILY LOAD TECHNICAL ADVISORY COMMITTEE

ARTICLE I
Name

The name of this Committee shall be *Silt Total Maximum Daily Load Technical Advisory Committee*, hereafter referred to as the "TMDL TAC".

ARTICLE II
Object

The objective of this Committee shall be to: (1) advise the staff of the Regional Water Quality Control Board, Colorado River Basin Region (hereafter referred to as "Regional Board") with respect to the development and implementation of silt TMDLs for Ag Drains, and the New and Alamo Rivers in a timely fashion; and (2) provide expert resources, scientific evaluations, and recommendations on TMDL documents (e.g., problem statement, draft TMDLs, implementation plans).

ARTICLE III
Members

Section 1 The Regional Board mailed out a letter on October 21, 1998, that solicited applications for inclusion on the TMDL TAC. All individuals who submitted a request for inclusion were included on the TAC.

Section 2 The membership of the TMDL TAC is:
Stephen Birdsall, Imperial County Agricultural Commissioner
Fred Cagle, Audubon Salton Sea Task Force
Bart Christensen, State Water Resources Control Board
Milton Friend, Salton Sea Science Subcommittee
Larry Gilbert, Farmer, Imperial Valley
Lauren Grizzle, Imperial County Farm Bureau and Imperial Valley Vegetable Growers
Juan Guerrero, University of California Cooperative Extension, Holtville Field Station
Steven Johnson, Sonny Bono Salton Sea National Wildlife Refuge
Al Kalin, Farmer, Imperial Valley
Tom Kirk, Salton Sea Authority
Leon Lesicka, Desert Wildlife Unlimited, Inc.
Ed McGrew, United States Filter Corporation
John Pierre Menvielle, Farmer, Imperial Valley
Carol Roberts, U.S. Fish and Wildlife Service
Robert Robinson, Coachella Valley Water District
Cheryl Rodriguez, U.S. Bureau of Reclamation (alternate: Joe Gleason)

Jennie Snyder, Imperial Irrigation District
James Walker, Farmer, Imperial Valley

Section 3 It shall be the responsibility of the individual members to provide the Committee with information that the member believes is important to the Committee. If there is information that a member believes should be made available to the entire TAC, the member will either supply said information for all members, or will provide the information to the Regional Board at least one week prior to the meetings in order to allow the Regional Board to distribute the information. Members of the TAC can submit potential agenda items to the chair person and or the Regional Board.

Section 4 Each member of the TAC may appoint an alternate to serve in his or her absence.

ARTICLE IV
Role of the Regional Board

Section 1 The Regional Board is ultimately responsible for all components of the TMDLs.

Section 2 The primary role of the Regional Board, with respect to the TMDL TAC, shall be to provide regulatory and technical guidance on issues related to the TMDL. The Regional Board shall be a non-voting member of the TMDL TAC.

Section 3 The Regional Board shall prepare and distribute agendas at least one week prior to the meeting.

Section 4 The Regional Board shall be responsible for preparing and distributing minutes in a timely manner.

Section 5 The Regional Board shall act as official secretary of the meeting.

ARTICLE V
Officers

Section 1 The officers of this committee shall be a Chairperson, Vice-Chairperson, and Secretary.

Section 2 It will be the role of the Chair to: (1) chair the meetings; (2) focus the discussion on the task at hand; (3) appoint Subcommittee Members as described in Article VII; (4) maintain communication with the Regional Board and any Committees as necessary; (5) protect the process by enforcing the Approach (Article VIII) and Basic Procedures (Article IX); (6) review agenda items, solicit agenda items from the TAC, and submit agenda items to the Regional Board; and (7) act as Timekeeper.

Section 3 It will be the role of the Vice-Chairperson to: (1) assist the chair as needed; and (2) substitute for the Chairperson in the event of his/her absence.

Section 4 It will be the role of the Secretary to record: (1) the result of any action items;(2) any motions that the TAC passes; and (3) minority reservations.

ARTICLE VI
Meetings

Section 1 Meetings shall be held on the third Monday of every month, at a time agreed upon by the TMDL TAC.

Section 2 The meetings shall be open to the public. Members of the public are asked to submit their comments/questions in writing to the Regional Board in order to allow the Committee to focus on its agenda items during the meeting time. All comments received on the subject of TMDLs, and Regional Board responses to those comments, will be distributed to the Members by Regional Board staff.

Section 3 Members of the audience and the TAC shall exercise respect during the proceedings of the meetings and should refrain from talking out of order.

ARTICLE VII
Subcommittees

Section 1 Subcommittees, standing or open, shall be appointed by the Chairperson as the TAC shall from time to time deem necessary to carry on the work of the TAC. The Chairperson shall be an ex officio member of all subcommittees.

Section 2 In appointing subcommittees, care should be taken to include representatives from multiple sides of the issue.

ARTICLE VII
Approach

Section 1 Interest-based problem solving approaches will be utilized at all times.

Section 2 Varying points of view will be welcomed and honored.

Section 3 It is assumed that all Members, while looking after their own unique interests, will also make an effort to keep a global view regarding all problems.

ARTICLE I
Basic Procedures

Section 1 Call to Order, Determination of Quorum, Order of Business
- Reading and Approval of Minutes
- Report of the Regional Board
- Reports of Officers and Sub Committees
- Unfinished Business
- New Business
- Public Comment

Section 2 Quorum

A quorum shall consist of at least seven TAC members.

Section 3 Robert's Rules

All business shall be conducted according to Robert's Rules of order.

Section 4 Recommendations to the Regional Board

In cases where a motion carries by a majority vote (without unanimous consent), recommendations to the Regional Board shall be provided in the form of a majority and minority opinion. The minority has the option to submit an opinion on any action.

APPENDIX B

Load Allocation Calculations
Summary

IMPORTANT FIGURES

Numeric Target = 200 mg/L
Conversion factor from mg/L to tons = 0.0013597
Future growth = 3% (based on calculations for future growth in the New River Sedimentation/Siltation TMDL)

SOURCE ANALYSIS FIGURES

Drain Name	Avg Flow (ac-ft/year)	Avg TSS @ Outlet (mg/L) aka concentration	Avg Sed Load (tons/yr) aka load
Niland 2	1264.0	410.0	704.7
P	2688.1	235.0	858.9
Pumice	47990.7	610.0	39803.9
All Drains	51942.8	418.3	29545.2

CALCULATIONS -- % OF TOTAL FLOW

Niland 2 $\frac{1264}{51942.8} = 0.0243 = 2.4\%$

P $\frac{2688.1}{51942.8} = 0.05175 = 5.2\%$

Pumice $\frac{47990.7}{51942.8} = 0.9239 = 92.4\%$

CALCULATIONS -- TOTAL CONCENTRATION

Tot Conc = Numeric Target - (instream erosion + wind deposition) - Margin of Safety
= 200 mg/L - 10 mg/L - 10 mg/L
= 180 mg/L

CALCULATIONS -- TOTAL LOAD (WITHOUT FUTURE GROWTH)

For all drains combined:
Load = (180 mg/L) (51942.8 ac-ft) (0.0013597) = 12,713 tons

For natural sources:
Load = (10 mg/L) (51942.8 ac-ft) (0.0013597) = 106.3 tons

For Margin of Safety:
Load = (10 mg/L) (51942.8 ac-ft) (0.0013597) = 106.3 tons

Therefore, total load is 12713 + 106.3 + 106.3 = 12,925.6 tons

CALCULATIONS -- LOAD ALLOCATIONS FOR INDIVIDUAL DRAINS

Niland 2	12713 x 0.0243	=	308.9 tons
P	12713 x 0.05175	=	657.9 tons
Pumice	12713 x 0.9239	=	11745.5 tons

CALCULATIONS -- LOAD ALLOCATION FOR FUTURE GROWTH

Future Growth 12713 x 0.03 = 381.4 tons

CALCULATIONS -- LOAD ALLOCATIONS FOR INDIVIDUAL DRAINS, ADJUSTED TO INCLUDE FUTURE GROWTH

Niland 2	12713 x 0.0243	=	308.9 tons without future growth
	381.4 x 0.0243	=	9.3 tons for future growth
	308.9 - 9.3	=	299.6 tons with future growth
P	12713 x 0.05175	=	657.9 tons without future growth
	381.4 x 0.05175	=	19.7 tons for future growth
	657.9 - 19.7	=	638.2 tons with future growth
Pumice	12713 x 0.9239	=	11745.5 tons without future growth
	381.4 x 0.9239	=	352.4 tons for future growth
	11745.5 - 352.4	=	11393.1 tons with future growth

CALCULATIONS -- % OF TOTAL LOAD ALLOCATION, ADJUSTED TO INCLUDE FUTURE GROWTH

Niland 2	299.6 tons / 12713 tons	=	.0236	=	2.4%
P	638.2 tons / 12713 tons	=	.0502	=	5.0%
Pumice	11393.1 tons / 12713 tons	=	.8962	=	89.6%
Future growth	381.4 tons / 12713 tons	=	.0300	=	3.0%
TOTAL					100.0%

COMPARISON

Drain Name	Current Avg Sed Load (tons/yr)	Target Avg Sed Load (tons/yr)	% Reduction
Niland 2	704.7	299.6	57%
P	858.9	638.2	26%
Pumice	39803.9	11393.1	71%

All Drains	29545.2	12330.9	58%

SUMMARY -- LOAD ALLOCATIONS

Sediment Source	# Of Drains Included in Segment	Sediment Load Allocation (tons/year)
Niland 2 drain	1	299.6
P drain	1	638.2
Pumice drain (including 5 Vail drains that drain into it)	6	11,393.1
Future Growth	None	381.4
Total Load Allocation for drains @ TSS = 180 mg/L	**8**	**12,712.3**
Natural Sources	Not applicable	106.3
Margin of Safety	Not applicable	106.3
Total Load Allocation for other sources @ TSS = 20 mg/L	**Not applicable**	**212.6**
TOTAL ASSIMILATIVE CAPACITY (Total Allocation for all sources @ TSS = 200 mg/L)	**8**	**12,924.9**

APPENDIX C

Silt TMDL Subcommittee for BMPs

Third and Final Revision November 12, 1999

Proposed Subcommittee Statement

Best Management Practices ("BMPs") as defined for water quality practices, can be any practices or methods that suitably address the goal of maintaining or enhancing the beneficial uses of water. The term "BMP" is misleading, however. It cannot be said that any so-called BMP will be the most effective option in any particular circumstance. Experience, professional judgment, and experimentation are always required for the successful implementation of appropriate pollution controls on a site-specific basis. For this reason, the term "management practice" is used in these recommendations rather than BMP.

A wide variety of generally effective management practices have been developed to reduce the impacts of runoff, erosion, and sedimentation or siltation from agricultural lands. Many of these management practices are now so widely incorporated into the technological baseline of modern American agriculture that they are taken for granted as part of the agricultural landscape. Soil and water conservation practices developed to reduce offsite transport of sediment from agricultural fields include such applications as berms, water bars, sediment basins, drainage ditches, field drains and sumps, contour plowing, sprinkler and drip irrigation, cover cropping, planting grass in waterways and field roads, vegetative buffers, windbreaks, retaining residual dry matter and minimum stubble heights, encouragement of fencing and off-stream stock water on grazing lands. Each of these practices can reduce silt under a particular set of circumstances. The practices vary widely from very simple and relatively inexpensive, to the extreme of retiring the farmland. Some of these practices are not feasible or -applicable to the crops and physical environment of the Imperial Valley.

The goal of this subcommittee is to select and describe management practices which experience in the field have demonstrated are most likely to be effective in achieving the goal of reducing the load of silt in agricultural drains of the Imperial Valley and the Alamo River. The object of these management practices is to prevent the drain water velocity from reaching that point where soil particles will be stirred up and carried with the flow. In the event soil particles are already suspended in the drain water, these practices will allow some of the soil particles to settle out before leaving the fields.

The subcommittee has compiled lists of practices from those agencies which have made them I available, with their accompanying documentation. We encourage managers to consider all potential practices and implement those which are best for them.

The subcommittee desires to focus attention on those practices which it expects will have the greatest impact on silt load for the crops and circumstances of the Imperial Valley. The subcommittee also desires to designate those practices which likely will be applicable to the broadest range of crops and circumstances, which are also expected to provide the greatest siltation reduction for the smallest financial investment, and are therefore the most likely to be chosen for implementation by prudent farm managers. With this in mind, we offer the following list of recommended management practices for reducing the load of silt leaving farm fields and entering the agricultural drains and the Alamo River when used individually or in combination with each other.

Since specific management practices do not apply to all operations, and are not practicable in all instances, the practices recommended below are not intended to serve as a prescriptive list. Effective management practices for specific sites and crops are best determined by the individual landowner relying on available expertise, and will continue to evolve as additional research and technology become available.

RECOMMENDED MANAGEMENT PRACTICES FOR SILTATION REDUCTION

Practices to Reduce Siltation by Managing Tailwater Ditches

Tailwater Drop Box Grade Elevation

Care should be taken to maintain the grade board elevation high enough to minimize erosion. Imperial Irrigation District's Regulation 39 states in part: *An acceptable structure shall have vertical walls and a permanent, level grade board set a maximum of 12 inches below the natural surface. If the situation warrants, and at the discretion of the district, 18" maximum may be allowed.* In many situations the elevation can be significantly higher, especially when anticipated tailwater flows will not reach elevations that will cause crop damage.

Enlarged Tailwater Drop Box

Widening the drop box overpour weir enables the weir elevation to be set higher without raising the surface elevation of the water above the acceptable level. Higher weir elevations allow for an increased tailwater ditch cross section, and reduced erosion when water leaving the field enters the tailwater ditch.

Tailwater Ditch Checks

These are temporary or permanent dams which hold the water level well above the ground. They can be placed at intervals in tailwater ditches, especially those with steeper slopes. They increase the cross section of the stream of water. They will decrease the water velocity and reduce erosion, and may even cause sediment already in the water to settle out. Check dams might be constructed of plastic, concrete, fiber, metal or other suitable material. If plastic sheets are used, care must be taken not to allow pieces of the plastic to be carried downstream with the water.

Enlarged Tailwater Ditch Cross Section
Deepening and widening the ditch will cause tail water velocity to decrease. The water must be checked up downstream of the oversized area to make the cross section of the water as large as practical. The slower the velocity the more sediment will settle out of the water and stay in the field, and the less will be picked up by the moving water.

Spillways to Drain Water Into Tailwater Ditches
Use of spillways or pipes where water moves from fields into tailwater ditches allows the tailwater to fall down into the tailwater ditch from the field without washing across and eroding the soil. Spillways might be constructed of plastic, concrete, metal or other suitable material. If plastic sheets are used, care must be taken not to allow deterioration to cause pieces of the plastic to be carried downstream with the water. This procedure may be useful on fields irrigated in bordered-strips and furrows.

Raising or Keeping Lower End of Field at Grade
Do not allow low spots to develop on the tail end of a field. In some cases it might be advantageous to maintain a reduced main or cross slope. This facilitates more uniform distribution of irrigation water to this area, which can result in reduced salt build-up in the soil, increased production, reduced tailwater, and decreased erosion.

Using Flat Area Between Furrow Ends and Field Tailditch
Allow water to flow slowly away from furrows without falling directly into the tailditch. Water then enters the tailditch only through spillways. This reduces erosion at furrow ends, especially when soil is freshly tilled and when water initially begins to flow from the furrows.

<u>Practices to Reduce Siltation by Eliminating Tailwater Ditches</u>

Draining Water Across End of Field
Eliminate borders on last 20-200 feet of the field. Maintain planted crop to the end of the field. Allow tailwater from upper lands to irrigate the crop at the ends of the adjacent lower lands. It is important that the main slope on the lower end of the field is no greater than on the balance of the field. A reduced slope might be better. With no tailwater ditch there should be very little erosion as the water slowly moves across a wide area of the field to the tailwater box. Some sediment might settle out as the water is slowed by the crop while it moves across the field. This could be used with water tolerant crops or special soil conditions.

APPENDIX D

BMP Recommendations of the U.C. Cooperative Extension

Potential BMPs for silt reduction in Imperial Valley drains, New River, & Alamo River

Compiled by UCCE-Imperial County (Bali & Guerrero)

Polyacrylamide (PAM)
Publications:
- Polymers check furrow erosion, help river life. *California Agriculture.* 1993.
- Other scientific publications available.

Runoff reduction & irrigation management
Publications:
- Field evaluation helps calculate irrigation time for cracking clay soils. *California Agriculture* 1994.
- Other scientific publications available.

Filter strips/grass waterways
Publication:
- BMPs for water quality- CTIC-National Association of Conservation Districts

Irrigation management (irrigation scheduling, CIMIS, etc)
Publication:
- Water Conservation: The Potential-UCCE

Runoff recovery systems, drop boxes, & economic incentives to reduce runoff
- IID

Pressurized irrigation systems (Drip, Sprinklers, etc)
Publications:
- Low-Volume irrigation- UCCE
- Drip irrigation for row crops- UCCE
- Micro-irrigation of trees and vines- UCCE

Surge irrigation
Publication:
- Surge Irrigation: A handbook for water management- UCCE

Conservation tillage practices
Publication:
- Sediments and water quality-UCCE

Design & management of surface irrigation (basin, furrow, border)
- Surface irrigation-UCCE
- BORDER-USDA-ARS
- BASIN-USDA-ARS

Field practices to reduce runoff (furrow dikes, cross-checks in border strips, land leveling, etc.)

Information about sediments and water quality:
Sediments and Water Quality (slide set & video)- UCCE
Outlines practices for controlling erosion, including conservation cropping, conservation tillage, the use of cover crops, and irrigation management. Also outlines practices for controlling sediments

UCCE Publications website: http://danr.ucop.edu/publications.htm